



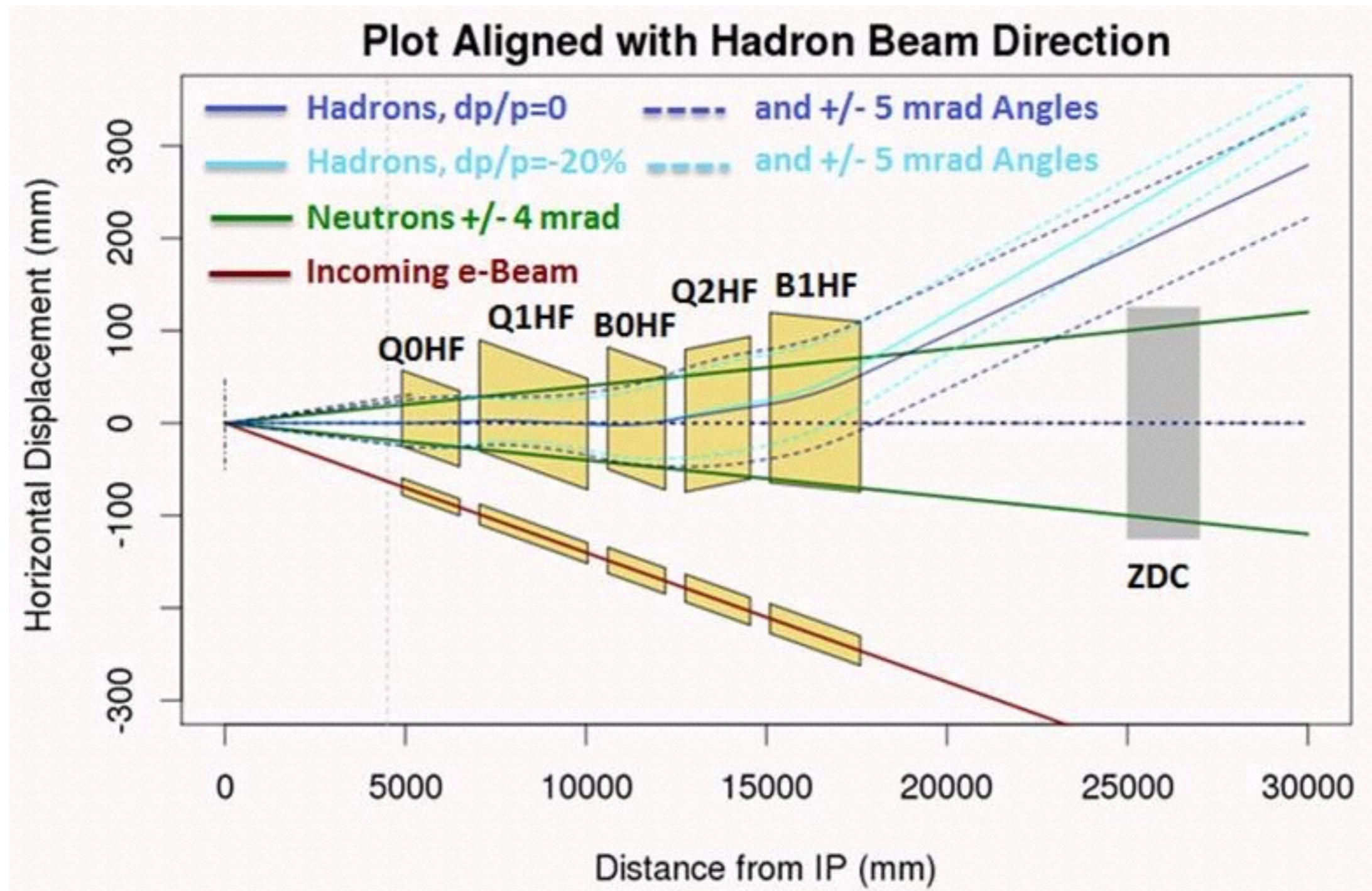
Stony Brook University

# Simulating the eRHIC Beam Line with Geant4 in Fun4All

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sPHENIX Cold QCD Topical Group Meeting  
Brookhaven National Laboratory, January 17, 2017

# Work-in-progress linac-ring eRHIC design near IR




# Implementation of beam line magnets in Fun4all / Geant4

Branch: BeamlineMagnet ▾







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sPHENIX-coresoftware / simulation / g4simulation / g4detectors /

This branch is 3 commits ahead, 18 commits behind sPHENIX-Collaboration:master. [Pull request](#) [Compare](#)

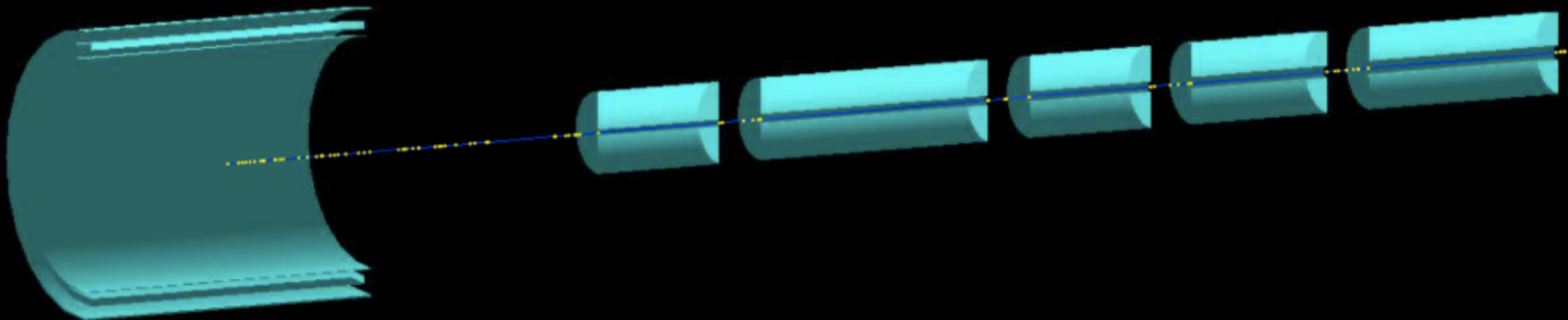
 nfeege Add proper units to field values Latest commit 40b5470 5 days ago

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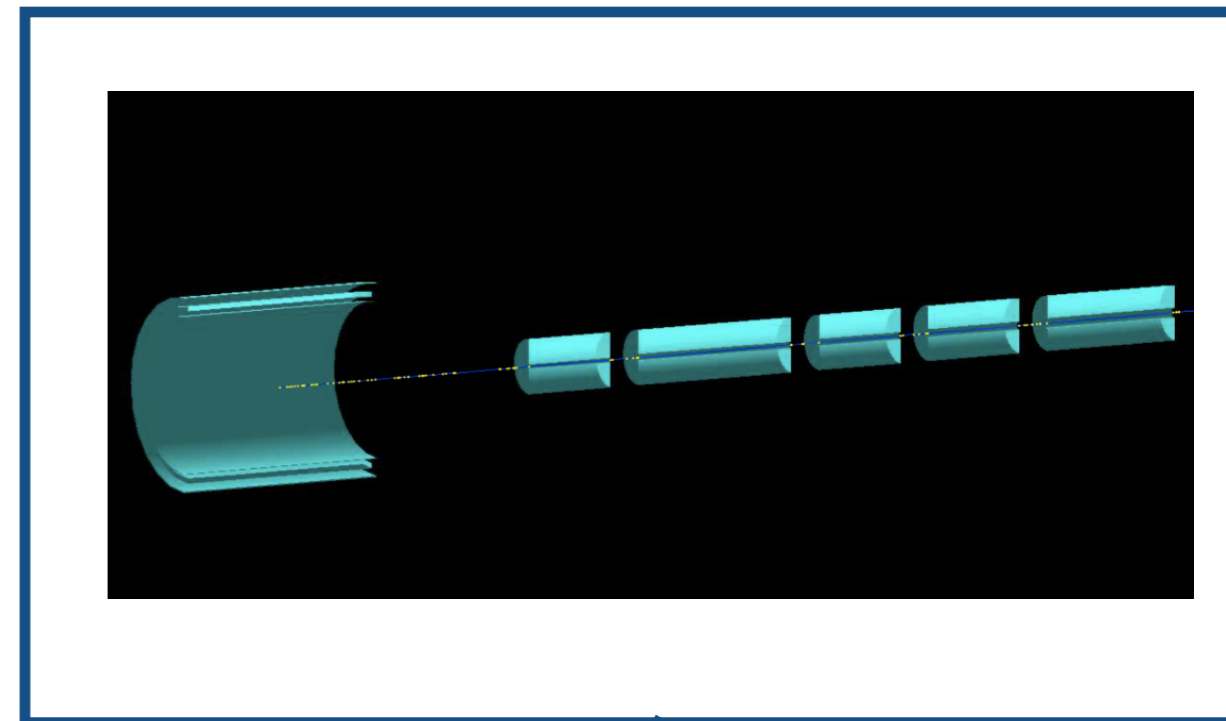
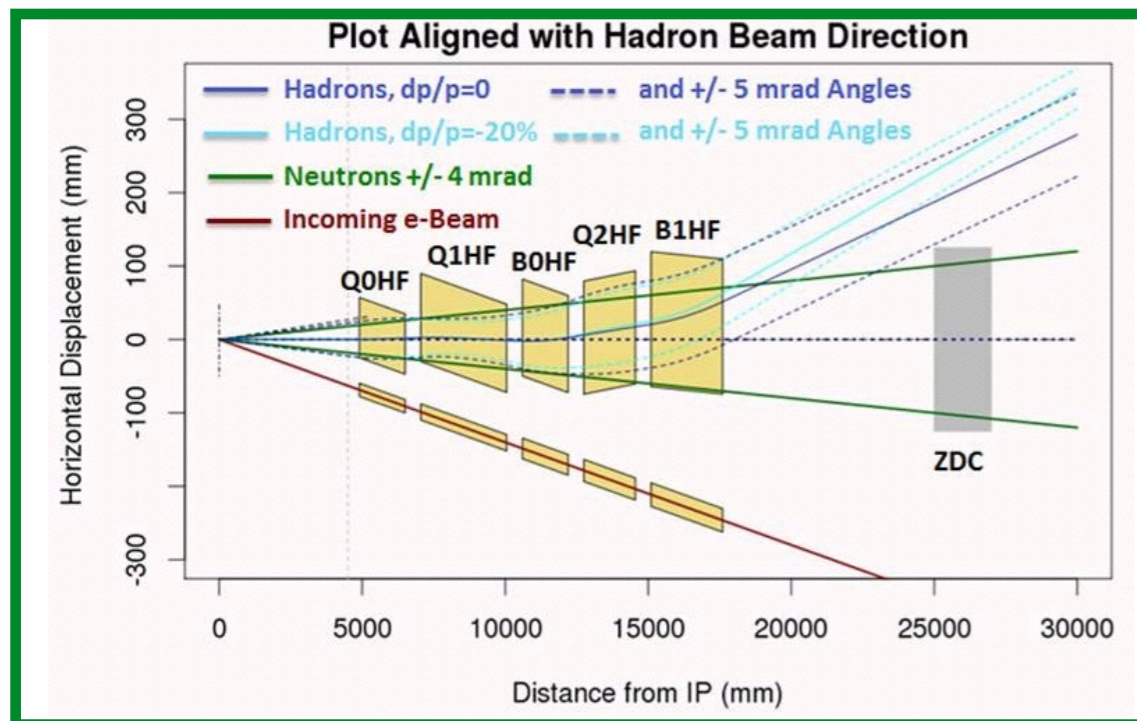
 <a href="#">Makefile.am</a>	Add new detector subsystem to model beam line magnets (i.e. upstream ...	6 days ago
 <a href="#">PHG4BeamlineMagnetDetector.cc</a>	Add proper units to field values	5 days ago
 <a href="#">PHG4BeamlineMagnetDetector.h</a>	Add new detector subsystem to model beam line magnets (i.e. upstream ...	6 days ago
 <a href="#">PHG4BeamlineMagnetSubsystem...</a>	Add rotation of beamline magnet based on parameters	5 days ago
 <a href="#">PHG4BeamlineMagnetSubsystem...</a>	Add new detector subsystem to model beam line magnets (i.e. upstream ...	6 days ago
 <a href="#">PHG4BeamlineMagnetSubsystem...</a>	Add new detector subsystem to model beam line magnets (i.e. upstream ...	6 days ago

- Cylinder shaped magnet with cylindrical aperture
- Size, position, rotation w.r.t. nominal beam line
- Fixed field dipole / fixed gradient quadrupole

# Implementation of beam line magnets in Fun4all / Geant4



# Test of new beam line magnet implementation



particle	p(GeV)	angle(mrad)	z(mm)
neutron	250	+4	30000
proton	250	0	30000
proton	250	+5	30000
proton	250*0.8	0	30000

x\_Brett(mm)

120.8

279.2

336.8

341.6

x\_Geant4(mm)

120.0

275.5

329.8

333.7

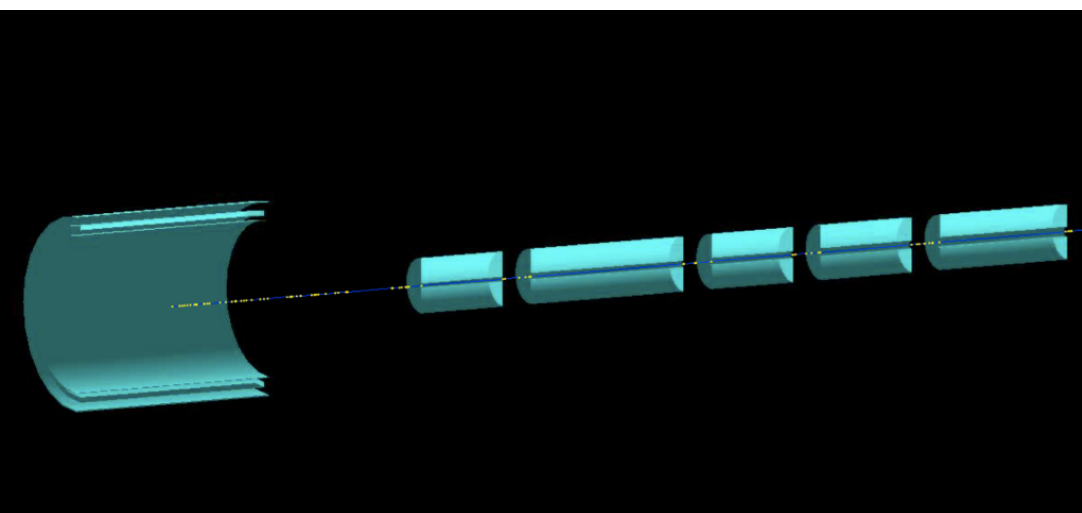
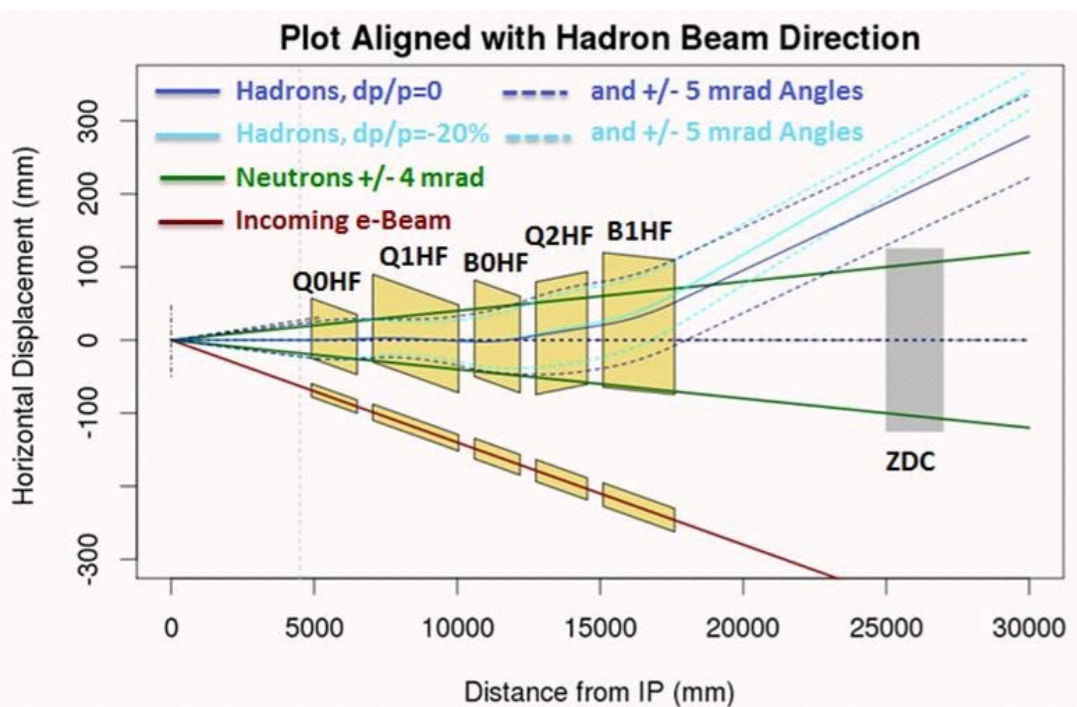
# Implementation of beam line magnets in Fun4all / Geant4

You can find the code on github:

<https://github.com/nfeege/sPHENIX-coresoftware>  
branch: "BeamlineMagnet"

and a Fun4All\_EICIR.C macro using it at:

<https://github.com/nfeege/sPHENIX-macros>  
branch: "eRhicIR"



Successful implementation of beam line dipole / quadrupole magnets in Fun4all / Geant4 as class BeamlineMagnetSubsystem.

Code clean-up in progress, plan to create pull request to sPHENIX base repository soon.

Will ask BNL CAD / Magnet Division for preliminary layout of beam line up to  $\sim 50$  m away from IP.

***ADDITIONAL SLIDES***

# Placing beam line magnets in Fun4All / Geant4

```
## protons, Draft linac-ring lattice V3.00, E_e = n/a, E_p=249.358GeV
## Source: 21-Apr-2016 from Brett Parker
##
## Notes: this is still a draft version with only the first few forward side magnets
##
## magnet_name1 center_x[m] center_y[m] center_z[m] aperture_radius[m] length[m] angle[mrad] B[T] gradient[T/m]
Q0HF      0.00500      0.00      5.70      0.041      1.600      -14.0      0.000      129.00
Q1HF      0.00900      0.00      8.55      0.060      3.000      -14.0      0.000      -86.00
B0HF      0.00500      0.00     11.40      0.066      1.600      -14.0      4.055       0.00
Q2HF      0.00955      0.00     13.65      0.077      1.800       7.8      0.000      59.50
B1HF      0.02261      0.00     16.35      0.092      2.500      -4.0      4.059       0.00
```